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# Impact of India Economic Policies on Cotton Production vis-à-vis Comparison between Pre-Economic Liberalization Policy Period and Economic Liberalization Policy Period

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**Abstract**

Cotton, textiles, and apparel are critical agricultural and industrial sectors in India with a significant role in the growth and development of the economy directly and indirectly given its prime position as a cash crop and export commodity. This study examined the impact of India economic policies in cotton production keeping in view the pre-liberalization policy period (1980-1989) and the economic liberalization policy period (1990-2014), viz investigation of the pattern of growth rate that marked the two critical and distinct policy in the economy of this crucial sector in India. The essence is to examine the key developments that emerged domestically and internationally during these two policy periods and the challenges and opportunities the sector faced. The empirical results showed that the sector witnessed excellent boost and performance during the period of economic liberalization as compared to what was seen during the pre-liberalization period where virtually all the key indicators that influence the performance of the sector exhibited stagnation in growth status. Excellent performance witnessed during the liberalization period is largely attributed to effective introduction of technological packages, sound economical and political policies. The impressive marginal trends in cotton production during the liberalization period was stemmed by the structural deregulation of the economy and was sustained of a very long period given that all the key indicators stimulating growth and development indicated marked acceleration growth status., while dismal marginal trend observed during the pre-liberalization period was stemmed by protectionism policy of the economy. The study recommends the need for further investments in human resource development to improve industry productivity and reduce poverty among workers in these sectors, the emergence of modern domestic retail marketing chains, and the potentially vibrant prospects for the industry that arise from a growing domestic fabric demand and new opportunities in world markets if appropriate policies and investments are undertaken. Furthermore, expansion of area currently under cotton cultivation in view adequate check on food crops to forestall danger of food security, biodiversity, agricultural crops cycle of the country in addition to agricultural extension, market liberalization, strengthening of research and networking, technology development and transfer, effective and efficient input delivery system to the farmers and guaranteed output markets is also recommended

***Keywords:*** Cotton growth, pre-liberalization period, liberalization period, world market, India.

World agriculture is passing through a distinct phase of transformation, called the second Green Revolution or Gene Revolution, in which modern technology enables the production of crops that are claimed to help resolve the pressing problems of food security, malnutrition and abject poverty in different parts of the world (Karihaloo and Kumar, 2009). This phase of transformation driven by the Green Revolution becomes more critical in so far as sustainable future of world agriculture is concerned, because, there are growing apprehensions all over the world that the Green Revolution technology as it unveils may have harmful consequences on sustainable livelihoods in view of the potential threats to food security and subsequent environmental and health challenges (Gruere and Sengupta 2011). According to Huang et al., (2011) an optimistic view about Green Revolution is that it was a strategic intervention involving technology, scientific knowledge and package of practices in many regions and was instrumental in achieving self-sufficiency in the production of food grains and sustaining it for several decades amidst growing population pressure on land, water and other scarce natural resources.

Raney and Matuschke (2011) cited that in the first decades of the Green Revolution, risks to human health and to the environment have been minimal. Consequently, the Green Revolution had little problem in achieving a desirable level of public acceptance that was necessary for the technology to have a significant impact on agriculture growth with necessary linkages. Viewed in that perspective, the Green Revolution had been a success in terms of broader coverage of crops and regions and progress in development and diffusion of state of the art technologies, farm mechanization, accelerated investments in rural infrastructure development, spread of Research and Development and extension activities, creation and maintenance of governance institutions and centres of excellence in many regions of the world. Thus, the GR created a social space for its own functioning in its own might with tremendous public sector funding for Research and Development, extension and smoother diffusion of the agricultural technology to the farmers at reasonable levels of costs. Kouser and Qaim (2011) reported that especially since the late 1980s, there has been growing realisation that the world agriculture is heading towards a crisis or an unsustainable growth path. Several decades of Green

Revolution experience across countries suggest that it had resulted in tremendous strains on the natural resources and unequal distribution of the welfare gains in the society (Lalitha and Viswanathan, 2009). First and foremost, the beneficial outcomes of Green Revolution have mostly favoured the rich and resourceful regions and sections of the society. The Green Revolution also left a number of human health problems unsolved and of course, has exacerbated the socioeconomic and environmental problems in very many cases. Furthermore, a significant part, small and marginal farmers with less and poor resource endowments received few benefits and in some cases became more deprived and poorer, as incentive systems and institutional structures have been less appreciative and supportive of the cause of their economic wellbeing. Among the various Green Revolution crops that gained commercial acceptance is cotton (Rao and Dev, 2010). Cotton is important both in developed and developing countries as a cash crop supplementing the livelihoods of millions of farmers, including small and marginal and as a strategic raw material for the textile industry. Though cotton is grown in about 100 countries, almost 73% of the world cotton area (35 million ha) and 80% of production (43 million MT) is contributed by six countries, *viz.*, US, China, India, Pakistan, Brazil and Uzbekistan (FAO, 2006). Nevertheless, differences exist across countries in terms of the basic crop/commodity performance indicators, such as area, production, productivity, trade, etc for a host of reasons that are quite known. Following the introduction of the genetically modified crops there has been significant rise in cotton area, especially the US, China, India, Australia, Argentina and South Africa. The area under hybrid cotton has increased from 0.03 million ha in 2002 - 2003 to 6.2 million ha in 2007 - 2008, accounting for 66% of global cotton area. Among the major cotton producing countries, India's status is distinct as the country occupies the prime position in terms of share of cotton area in the world (26%), but lags far behind in terms of production (16%) with lowest productivity (520 kg/ha) in the world (Subramanian, 2011).The major reasons indicted for India's low-productivity of cotton, inter alia, include predominance of smaller and marginal holdings, inadequate transfer of production technology and Inadequate financial resources.

Cotton, cotton-related products, textiles, and apparel are

important commodities that make up critical agricultural and industrial sectors in India (James, 2008). A number of key developments are emerging domestically and globally that will potentially have profound effects on the cotton-textile-apparel sectors of the economies. The industries face the challenge of remaining competitive in the context of the elimination of the multi-fiber agreement (MFA) quotas on textile and apparel trade under the world trade organization (WTO), the emergence of china as a huge textile and apparel exporter, and new and potential intraregional trade agreements. Implementation of the final WTO ruling against U.S cotton subsidies, a new U.S. farm bill in 2008, and a possible agreement to multilaterally reduce cotton subsidies and tariffs across the related textile and apparel sectors in Doha Round of WTO negotiation may also affect the cotton and cotton-related processing industries of India (Jatinder and Caesar, 2008).

India's cotton sector directly supports about 5 million farmers spread across 9 states and it occupies a pivotal position in the domestic economy as a strategic industrial raw material for the textile industry. With a cultivated area of around 9 million ha, India ranks first in world cotton area and is the third largest cotton producer after US and China. Even though India ranks first in cotton area, its productivity is one of the lowest in the world. Almost 65% cotton cultivation is rain dependent (APCoAB, 2006). Though cotton is grown in nine states, four states, viz., Maharashtra, Gujarat, Andhra Pradesh and Punjab together accounted for 77% of cotton grown area and 76% of cotton production during 2006 – 2007.

As evident, trends in area and production of cotton indicate contrasting scenarios of growth, as there has been significant increase in cotton production over time while area under cotton tends to stagnant at the national level. Cotton yields in global terms are low, but India has more land under cotton than any other nation. In the past 10 years, India, formerly self-sufficient or net- cotton-importing nation has become the world's second producer and exporter of cotton, by doubling its production in five years (Subramanian and Qaim, 2010). In a country of India size, one of the biggest challenges is feeding a population of 1.1 billion. Population trends project India to emerge as the most populous country in the world in the coming decades. Demand and supply prospects of agricultural

products become important indicators to the country's food security concerns. These projections are based on growth in population, income, price change and change in productivity levels (IndiaStat, 2012). Policymakers are continuously confronted with the dilemma of adopting a liberal trade policy vis-à-vis intervening in markets to ensure food security, especially for the poor. As growth accelerates in India, policymakers face big questions of "what will happen to Indian demand for agricultural products in general and food in particular; will India be able to feed itself or will it lead to large imports of agricultural products as has been the case with China?" This is a crucial issue since India continuously faces pressures on the demand-side arising from continuous population growth. Over time, limited land availability and several other production deterrents might also emerge as constraints on the supply of goods. With the impending food security issue on their minds, policymakers recognize the urgent need to empirically asses the future of cash crops in India. Indeed, despite ongoing controversies among civil society groups, more than 25 farmer surveys in Indian cotton-producing states have demonstrated the overall positive impact of the technology on yields, even if with significant variance across locations, varieties, and over time (Karihaloo and Kumar, 2009).

Furthermore, additional empirical studies in India have shown that increased cotton production resulted in increased women's labour opportunities, thereby contributing to poverty reduction (Subramanian, 2011). More than four million households produce cotton in India, and about one-quarter of output is produced by marginal and small farms. The Eleventh Plan aims to achieve a 9 per cent per annum economic growth, with agriculture and allied sectors growing at the rate of 4 per cent per annum (Press Trust of India, 2011). It is important to assess the feasibility of achieving this growth rate because agriculture is constrained by a number of factors of which supply and demand constraints are crucial ones. The imbalance between production and demand has effects on trade implication on cotton sector, which calls for policy interventions and planning to tackle the situation in future. However, an in-depth understanding of the dynamics of cotton products consumption for developing economies like India is invaluably important not only for academic exploration but also for policy formulations.

## Materials and Methods

The research made use of time series secondary data. Time series data for the period of 1980-2014 for area, production and productivity of cotton in India sourced from United State Department of Agriculture (USDA) database was used. Suitable tools such as growth model, regression time trend model, coefficient of variation, Instability index, Lorenz curve, Gini coefficient and doubling time model were used to analyze the data. Growth model was used to estimate the growth rates, regression time trend model was used to estimate growth rates status, coefficient of variation and Instability index was used to ascertain instability in growth, Lorenz curve and Gini coefficient were used to determine the distribution pattern and doubling trend was used to determine the need for intensification of the sector.

### *Empirical Model specification*

**Growth Rate:** The growth rates were calculated by fitting an exponential function in time to the data as follows:

$$Y = \beta_0, \beta_i^t \qquad \text{................................. (1)}$$

Linearising the equation, it becomes:

$$\text{Log } Y = \beta_0 + \beta_i^t \qquad \text{............................ (2)}$$

Where,

Y = Production, Area and Productivity;

t = time trend variable; and,

$\beta_0$ and $\beta_{i's}$ are regression parameters to be estimated.

The compound growth rate (r) is given by the formula:

$$r = (e^{\beta i} - 1) \times 100 \qquad \text{.............................. (3),}$$

Where,

e = Euler's constant/ Antilog;

Euler's constant = 2.71828;

Antilog = $10^{\beta i}$

**Growth Status:** Following Marchenko (2009), a quadratic equation in time variable was fitted to the data to confirm the existence of acceleration, deceleration or stagnation during the same period and it was given as follows:

$$\text{Log } Y = \beta_0 + \beta_i t + ct^2 \qquad \text{............................. (4)}$$

Where c is the regression coefficient used to depict acceleration, deceleration or stagnation. In the equation 5 above, the linear and quadratic time terms gives the circular path in the dependent variable (Y). The quadratic time term ($t^2$) allows for the possibility of acceleration, deceleration or stagnation during the period. Significant positive values of the coefficient of $t^2$ indicates acceleration in growth; significant negative values of $t^2$ indicates deceleration in growth; while non-significance of the coefficients indicates stagnation in the growth process.

1. **Gini Coefficient:** It is a measure of statistical dispersion developed by the Italian statistician Corrado Gini and published in his paper "variability and Mutability" (Italian: *Variabilita e mutabilita*). The Gini index is defined as a ratio of the areas on the Lorenz curve. The formula is given as follows:

   $$G = A/0.5 = 2A = 1-2B \text{ ............................} (5)$$

2. **Measurement of Instability:** The instability was measured for both periods by estimating the coefficient of variation. The coefficient of variability (CV) which measure instability is a normalized measure of dispersion and is the ratio of standard deviation (σ) to the mean (μ):

Algebraically,

$$CV = \frac{\sigma}{\mu} \text{ ........................ (6)}$$

One important point might be noted in connection with the use of CV which is the most commonly used index for measuring instability. CV has an easy interpretation in the context of measuring variation in data not showing any trend. But usually when we have a time series for variables showing some kind of trend, which may be linear or non-linear, CV does not take into account any such time trends of the data while measuring instability in the variant values. Thus, it is desirable for general applicability that an index of instability should be used to give information about the trend exhibited in the data on the variable under study. Therefore, the following index was suggested as a

measure of instability in time series data:

$$I = CV^2(1-R^2) \qquad \text{...........................} (7)$$

I = Instability Index

$R^2$ = Coefficient of determination

**Doubling Trend:** The time it would take to double the rate of growth was estimated as follows:

$$Dt = 69/r \qquad \text{.........................................} (8)$$

Where,

Dt = Doubling time; and,

r = compound rate of growth.

## Results and Discussion

**Growth Trends of Cotton Production**: An effort was made to measure the growth rates for the most important key indicators that influence the growth and development of cotton economy in India during the periods under pre-liberalization policy and economic liberalization policy. These key indicators are production, area, yield, domestic consumption, export and import information from the marked year pre-liberalization policy period (1980-1989) to the economic liberalization policy period (1990/1991-2014). Many studies reported that there was remarkable improvement in the economy of cotton sector during economic liberalization period as compared to pre-liberalization policies period which focused towards protectionism with a strong emphasis on import substitution, industrialization under state monitoring, state intervention at the micro level in all businesses especially in labour and financial markets, a large public sector business regulation and central planning. These researchers attributed the remarkable growths/improvements achieved to better utilization of existing infrastructure in addition to wider adoption of hybrid (Bt) varieties and yield raising technology. Yet there is widely shared reservation in this context that a period of successively good economic liberalization policies is mainly responsible for the steadiness or improvement in growth of cotton sector. Therefore, to have a more realistic understanding of growth in cotton sector, it is necessary to update the assessment of growth by extending the database to date as also to make it more scientific through

meticulous analysis. For the pre-economic liberalization period (Table 1) the growth rate for production, yield, area, domestic consumption, export and import were all stagnant while the liberalization policy period growth rates for all the key indicator for sectoral growth were accelerative. The possibility of area expansion during the pre-liberalization policy period was meager or none. For area expansion, it is required that the crop should exhibit a positive/accelerative yield growth over the period. By seeing the growth pattern in area and yield of crop we can conclude how the crop sector performed between the two sub periods in the country. The combination of area and yield growth (positive/negative) with the yield status (acceleration/deceleration/stagnation) indicates the performance of a crop in a given periods, since the trend in crop production is the composite reflection of the trends in both area and yield. It is vividly clear that the pre-liberalization policy period was driven towards protectionism, while economic liberalization policy period clearly points towards making the economy more market-oriented and also expanding the role of private and foreign investment. Thus, it can be concluded that after the adoption of new economic policy (liberalization policy) the growth rate status in the economy of cotton sector in the country has witnessed a remarkable performance, i.e significantly increase with excellent performance for all the cotton subsectors that is required to contribute positively to the development of the economy in general. Therefore, it signifies that after the adoption of the economic liberalization policy in 1990 the growth rates status increased favourable when compared to the pre-liberalization period, with the excellent percentage in growth rate been attributed to massive shift in area under food crops to this tempted cash crop which has remunerative commercial profit given its good market status outside the country. The study suggest that to further boost production, area under cotton cultivation should be increased vis-à-vis intense research to evolve high yielding and short duration varieties of cotton in the country. Moreover, the results of acceleration clearly buttress and prove the prime leading position of India in cotton production in the world and the reaffirmation that it is home of cotton production. Neither deceleration nor stagnation in growth of cotton economy was observed in India during the liberalization policy period. This result is an improvement over (Jatinder and

Caesar, 2008) earlier findings. This may be attributable to the observed intervention policies by the government geared at improving cotton sector in the country, one of which was drastic increment in exportation and massive support of domestic production. The growth trends for the two periods are depicted in figure 1.

**Table 1: Growth trend pattern in cotton production in India**

| Pre-liberalization policy period (1980-1989) | | | |
|---|---|---|---|
| Variables | CGR | CGR status (Quadratic fitted) | |
| Production | 0.5% (3.31)** | $\beta 1$: 0.029 (0.45)$^{ns}$ | Stagnation |
| | | $\beta 2$: 0.001 (0.25)$^{ns}$ | |
| Area | -0.2% (2.82)** | $\beta 1$: -0.04 (1.49)$^{ns}$ | Stagnation |
| | | $\beta 2$: 0.002 (0.89)$^{ns}$ | |
| Yield | 1.1% (5.19)*** | $\beta 1$: 0.07 (1.19)$^{ns}$ | Stagnation |
| | | $\beta 2$: -0.001 (0.12)$^{ns}$ | |
| Domestic consump-tion | 0.5% (7.58)*** | $\beta 1$: 0.042 (0.10)$^{ns}$ | Stagnation |
| | | $\beta 2$: 0.000 (1.52)$^{ns}$ | |
| Export | -1.9% (0.663)$^{ns}$ | $\beta 1$: -0.052 (0.84)$^{ns}$ | Stagnation |
| | | $\beta 2$: 0.04 (0.75)$^{ns}$ | |
| Import | 8.2 (0.96)$^{ns}$ | $\beta 1$: 1.06 (0.47)$^{ns}$ | Stagnation |
| | | $\beta 2$: -0.072 (0.38)$^{ns}$ | |
| liberalization policy period (1990-2014) | | | |
| Variables | CGR | CGR status (Quadratic fitted) | |
| Production | 1.5% (12.68)** | $\beta 1$: 0.023 (1.38)$^{ns}$ | Acceleration |
| | | $\beta 2$: 0.001 (1.89)* | |
| Area | 1.2% (7.54)*** | $\beta 1$: -0. 003(-0.32)$^{ns}$ | Acceleration |
| | | $\beta 2$: 0.001 (2.38)** | |
| Yield | 1.6% (9.88)*** | $\beta 1$: 0. 026(0.098)$^{ns}$ | Acceleration |
| | | $\beta 2$: 0.003 (7.88)*** | |
| Domestic consump-tion | 0.4% (23.71)*** | $\beta 1$: 0. 041(5.9)*** | Deceleration |
| | | $\beta 2$:-0.000 (1.78)* | |
| Export | 2.3% (3.80)*** | $\beta 1$: -0.22(1.68)$^{ns}$ | Acceleration |
| | | $\beta 2$: 0.015 (3.03)*** | |
| Import | -1.6% (2.64)*** | $\beta 1$: 0. 28(2.18)** | Stagnation |
| | | $\beta 2$: -0.007 (1.58)$^{ns}$ | |

*Source*: USDA, 2014

## Distribution Pattern of Cotton Production in Pre-Economic Liberalization Policy Period and Economic Liberalization Policy Period

Inequality in distribution pattern of cotton over each period was investigated with the aid of Lorenz curve. The Lorenz curve (Figure 2a) for cotton production during pre-liberalization period clearly depicts a slight margin distance from the line of equality which means that the output level during this period has an equal distribution with an insignificant marginal changes; minimal spread as indicated by the value of coefficient of variation index (CV) (0.19); retrogressive transfer in quantity of production. Gini coefficient index (0.30) confirms what one could graphically visualize under the Lorenz curve: the area between Lorenz curve and line of equality was 0.15. Therefore it can be inferred that the production level during this period was on small-scale, and apart from that, the production entirely depends on rainfed with little technological facilities since the policy during the pre-liberalization policy was protectionist one. This graphical visualized outlook further confirms the reason for the stagnant growth that was found during the pre-liberalization policy period. For the period of economic liberalization the Lorenz curve (Figure 3a) clearly depicts a more margin difference from the line of equality when compared with the graphical visualized outlook during the pre-liberalization period. The graphical visualization during the liberalization period was confirmed by the Gini coefficient index (0.61) which indicates that there was more inequality in the output distribution during the period of economic liberalization. This implies there were significant marginal changes in output levels during this period. As such it can be concluded that the liberalization policy triggered cotton production through supportive policies such as provision of technological facilities: hybrids, agrochemicals, irrigation facilities, machineries; economic facilities: credit facilities, subsidies and also political wills which enhance efficiency in the use of resources, given that the product was produced throughout the year with virtually majority of the arable lands been subjected to both rainfed and irrigation. The high index value of coefficient of variation clearly indicates that there was massive shift from low production quantum which was the practice during the pre-liberalization period to high production quantum, since the liberalization period
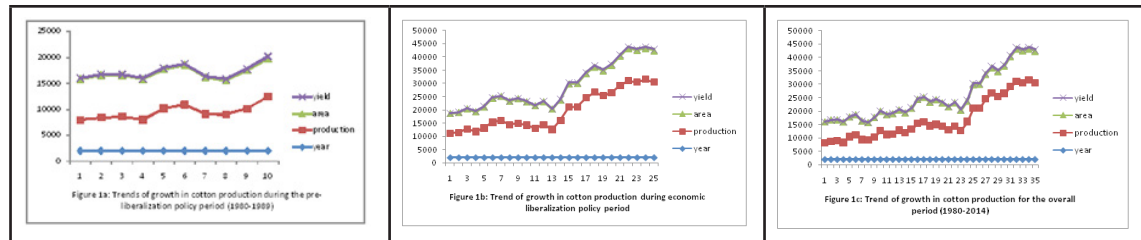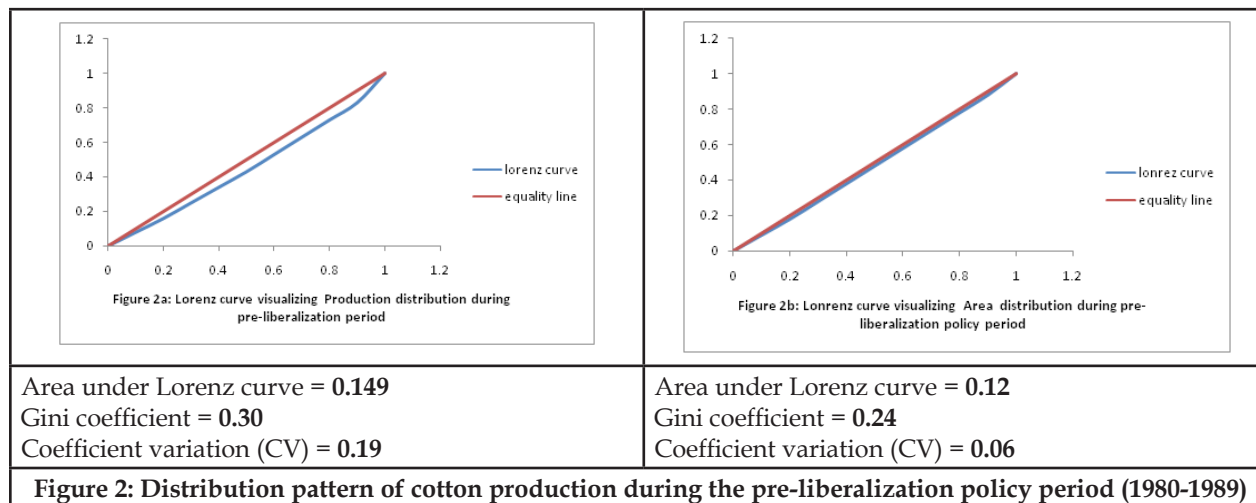
**Figure 1: Trends of Growth rate in cotton production in India**



| | |
|---|---|
| Figure 2a: Lorenz curve visualizing Production distribution during pre-liberalization period | Figure 2b: Lonrenz curve visualizing Area distribution during pre-liberalization policy period |
| Area under Lorenz curve = **0.149**<br>Gini coefficient = **0.30**<br>Coefficient variation (CV) = **0.19** | Area under Lorenz curve = **0.12**<br>Gini coefficient = **0.24**<br>Coefficient variation (CV) = **0.06** |

**Figure 2: Distribution pattern of cotton production during the pre-liberalization policy period (1980-1989)**

was driven towards market orientation both internal and international. The value of the CV (0.44) further confirms that a progressive production transfer during this period was very impressive. This massive and rapid improvement in cotton production in the country should be linked to the liberalization policy since changes were evident and conspicuous during this period. Furthermore the margin in the Lorenz curves (Figure 2b-3b) for area under cotton production for the both period indicates that there exist less inequality in area distribution during pre-liberalization policy period and inequality during the liberalization policy period. This means that during the pre-liberalization policy period there was equal distribution in the area under production, while the wide margin evidence during the liberalization period reveals more allocation of area to cotton production which becomes mechanized in production. This graphical visualization was further confirmed by Gini coefficient indexes for both period (pre-liberalization = 0.24, liberalization = 0.50). However, the liberalization period witnessed a slight inequality in

the distribution of area under cotton production, given that there was adjustment (increase) in area allocated to cotton production among the few cotton producing states in India. This was evidence by the sudden jump in the output during the liberalization period. Nevertheless, on time comparison between the pre and liberalization period, the coefficient variation clear points to the fact the largest cotton producing states increased the allocation of area under cotton production by means of slight shift in area under food crops keeping in view their food security status. This unequally distribution is attributed to the fact that cotton production in the country is concentrated in few states. This is factual because relevant statistics and articles indicates that 99.9 percent of cotton production is concentrated in just ten states with Gujarat (33.3%), Maharashtra (24.4%) and Andhra Pradesh (13.4%) accounting for the highest share. Other states that trail behinds are Punjab, Haryana, Rajasthan, Karnataka, Madhya Pradesh, Tamil Nadu and Orissa.

## Magnitude of Instability in Cotton Production in India

Instability is one of the important decision parameters in development dynamics an more so in context of agricultural production. Analysis of fluctuations in agricultural production, apart from growth is of importance for understanding the nature of income generation to farmers, foreign exchange earnings, growth of agricultural based industries and food security to consumer. Growth and instability of area and yield have an enormous and direct impact on growth and instability of production. Therefore, apart from growth performance of the two periods, instability in cotton production during the pre-liberalization policy period and liberalization policy period was investigated. In other to investigate the instability in production, area and yield in the two periods the coefficient of variability and instability were index were estimated for both periods as well as the overall period and it is given in Table 2. The combination of growth rate and instability together gives a meaningful interpretation about the growth pattern and directly reveals the policy direction to enhance the performance of the crop. The level and magnitude of instability in the area and yield was compared with the overall time period to define the periods in different categories. If the magnitude of instability in a period is more than the overall period magnitude, then that period is referred to as instable and vice versa. The result

in Table 2 reveals that both periods were characterized by less erratic fluctuation which may be due to the fact that the effect of global warming on production during the pre-liberalization policy was not minimal while the stability observed during the liberalization policy period was attributed to the fact that majority of the arable land were cultivated throughout the year owing to effective irrigation system.

**Table 2. Magnitude of Instability in Cotton Production in India**

| Variables | Pre-liberalization (1980-1989) | | Liberalization (1990-2014) | | Overall period (1980-2014) | |
|---|---|---|---|---|---|---|
| | CV | II | CV | II | CV | II |
| Production | 0.19 | 0.02 | 0.42 | 0.02 | 0.52 | 0.02 |
| Area | 0.06 | 0.0018 | 0.16 | 0.007 | 0.17 | 0.006 |
| Yield | 0.21 | 0.010 | 0.28 | 0.015 | 0.37 | 0.026 |

Note: CV= Coefficient of Variation, II= Instability Index

**Doubling Time:** Table 3 forecast into future the time required to double the current growth rate of the period under liberalization policy. The result indicates that 46, 57.5 and 43.1 years respectively for production, area and productivity are the doubling time required. This implies that it will take about 46 years to double the rate of production under cotton production; 57 years 6 months



Figure 3a: Lorenz curve visualizing Production distribution during liberalization policy period
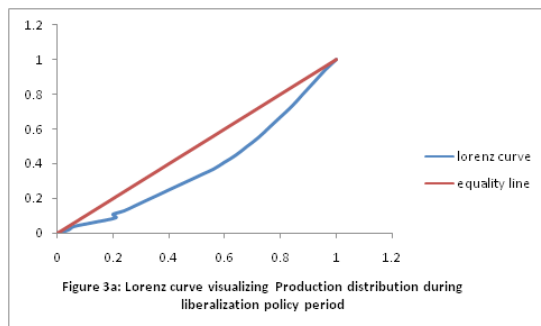
Area under Lorenz curve = **0.30**
Gini coefficient = **0.61**
Coefficient variation (CV) = **0.44**



lorenz curve for Area during the liberalization policy period
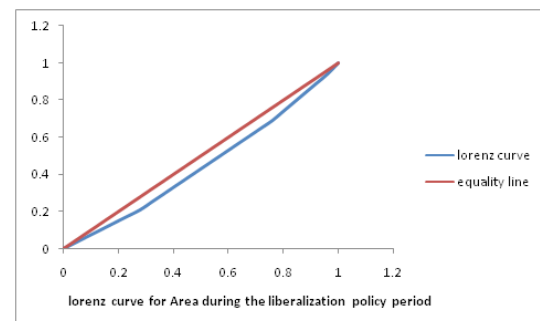
Area under Lorenz curve = **0.25**
Gini coefficient = **0.50**
Coefficient variation (CV) = **0.175**

**Figure 3: Distribution pattern of cotton production during the liberalization policy period (1990-2014)**

to double the rate of area and 43 years 1 month to double the rate of productivity, respectively on the current trend. Therefore it means that adoption and full implementation of commercial agriculture by placing significant emphasis on its intensification cannot be overemphasized. This is required in order to achieve the needed demand in cotton industries and consumer demand, thereby translating to a viable cottage industry.

**Table 3: Doubling time for growth rate in cotton production for the period under economic liberalization**

| Variables | Doubling time (years) |
|---|---|
| Production | 46 |
| Area | 57.6 |
| Yield | 43.1 |

*Source:* Growth rate estimates, 2014

## Conclusion

The research reveals that cotton production in India witnessed excellent boost and performance during the period of economic liberalization as compared to what was seen during the pre-liberalization period where virtually all the key indicators that influence the performance of the sector exhibit stagnation in growth status. Excellent performance recorded during the liberalization period is largely attributed to effective introduction of technological packages such as introduction hybrid varieties, irrigation facilities, credit facilities; subsidies etc, coupled with successful implementation of land reforms programme set the path of agricultural development in the country. Furthermore, the impressive marginal trends in cotton production during the liberalization period was stemmed by the structural deregulation of the economy, while dismal marginal trend observed during the pre-liberalization period was stemmed by protectionism policy of the economy. This scenario of impressive growth was sustained for a very long period, because all the key indicators that influence growth and development to significant extent indicate acceleration in growth trends. in the sector indicates. The acreage under cotton in India has shown large amount of variation over the decades investigated. The pattern of fluctuation was stable for both periods hence linear in fashion. Measures to stimulate cotton production in India would therefore include expansion of the area under cultivation in addition to agricultural extension, market liberation, greater investments to improve the well-being and productivity of farmers through education, improving farmers' access to productive inputs, strengthening of research, technology development and transfer as well as an effective and efficient input delivery system to the farmers and output markets. These should be made to ride on favourable macroeconomic environment, advanced development of rural infrastructure and the sustainability of the environment in the quest for stimulating agricultural growth.

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